



11-15-05

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Dimitar V. Dimitrov	Appeal No.
Appln. No.	:	10/050,236	
Filed	:	January 15, 2002	Group Art Unit: 3729
Title	:	METHOD FOR FORMING A MR READER WITH REDUCED SHIELD TOPOGRAPHY AND LOW PARASITIC RESISTANCE	Examiner: Tugbang, Anthony D.
Docket No.	:	I69.12-0526	

**BRIEF FOR APPELLANT**

Mail Stop Appeal Brief-Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

**SENT VIA EXPRESS MAIL**

Express Mail No.: EV 655617876 US

This is an appeal from an Office Action mailed June 14, 2005, in which claims 1-8 were finally rejected and claims 9-32 were withdrawn as being drawn to a nonelected invention.

A Petition From Requirement for Restriction Pursuant to 37 C.F.R. § 1.144 was filed with the Commissioner for Patents on September 13, 2005. Specifically, Applicants petitioned a first requirement for restriction between claims 1-8 (Group I) and claims 9-18 (Group II), and a second requirement for restriction between claims 2-5 (Group II) and claims 21-32 (Group III). Independent claim 1 links claims 2-5 and 21-32, and upon the allowance of claim 1, the second requirement for restriction between claims 2-5 and claims 21-32 should be withdrawn.

**Real Party in Interest**

The real party in interest is Seagate Technology LLC, a limited liability company organized under the laws of the State of Delaware having an office in Scotts Valley, California, who is the owner of the entire right, title and interest in the application.

**Related Appeals and Interferences**

There are no known related appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

11/16/2005 NNGUYEN1 00000011 10050236

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**Status of the Claims****I. Total number of claims in the application**

Claims in the application are: 1-32, inclusive.

**II. Status of all the claims**

A. Claims canceled: None

B. Claims withdrawn but not canceled: 9-32

1. Withdrawn claims subject to Petition From Requirement for Restriction

Pursuant to 37 C.F.R. § 1.144: 9-18 and 21-32

2. Withdrawn claims not subject to Petition From Requirement for Restriction

Pursuant to 37 C.F.R. § 1.144: 19-20

C. Claims pending: 1-32

D. Claims allowed: None.

E. Claims rejected: 1-8

F. Claims objected: None.

**III. Claims on Appeal**

A. The claims on appeal are: 1-8.

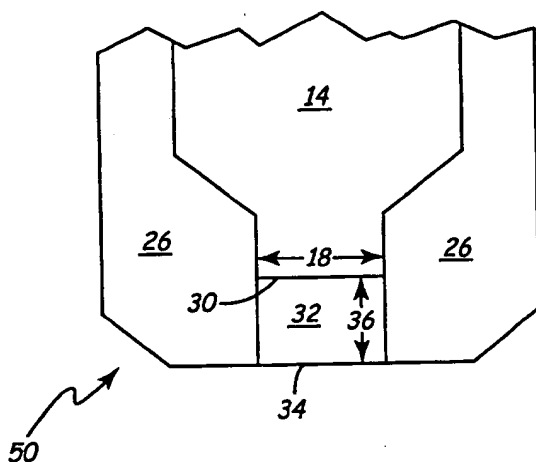
**Status of Amendments**

A Response After Final was filed on August 15, 2005, presenting arguments for the allowance of claims 1-18 and 21-32. As noted in an Advisory Action mailed on August 29, 2005, the Examiner considered the Response After Final, but found it did not place the application in condition for allowance.

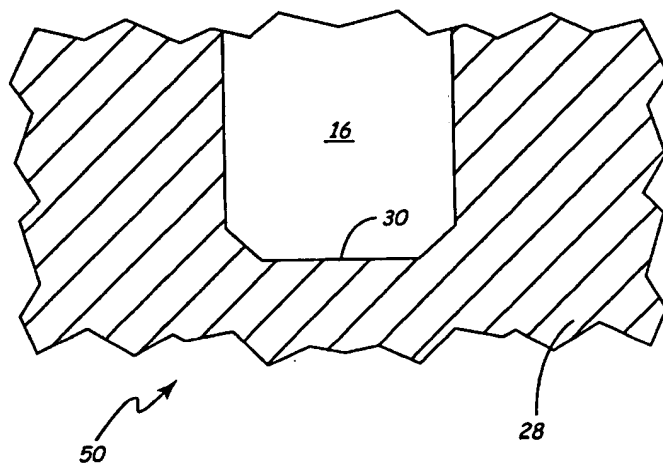
**Summary of the Claimed Subject Matter**

The present invention is directed toward a method of forming a magnetoresistive (MR) sensor. A MR sensor of a MR reader is formed by defining four critical edges: a front edge and a back edge defining the stripe height of the sensor, and side edges defining the width of the sensor (i.e., the reader width). (See page 4, lines 19-22). Looking to FIG. 8 of the present application (copied below), which shows a cross-sectional view of a MR reader (50), the four critical edges of MR sensor (32) are a stripe height front edge (34), a stripe height back edge (30), and the side edges of a MR reader width (18). A distance between the stripe height front edge (34) and the stripe height back edge (30) define a final stripe height (36) of MR sensor (32). Also shown in FIG. 8 are bottom half-gap (14) and contacts (26).

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**FIG. 8**

Conventionally, the reader width (18) is defined first, followed by definition of the stripe height back edge (30) and then the stripe height front edge (34). (See page 4, lines 17-21). In accordance with the present invention, **first**, the stripe height back edge (30) of the MR sensor (32) is defined, and **second**, a reader width (18) of the MR sensor (32) is defined. (See page 4, lines 19-20). These two steps are shown in FIGS. 6 and 7 of the present application, which are both cross-sectional views of the MR reader (50). In FIG. 6, photoresist (28) is selectively patterned on MR sensor layers (16) in order to define stripe height back edge (30).

**FIG. 6**

Subsequently, as shown in FIG. 7, photoresist (20) is selectively patterned on the remaining MR sensor layers (16) in order to define reader width (18). Contacts (26) may then be

deposited. A resulting structure is shown in FIG. 8, *supra*.

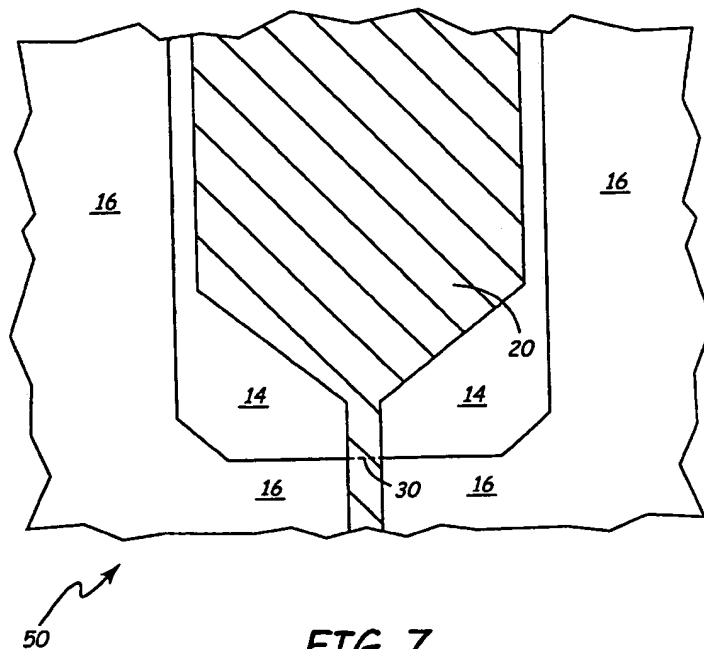
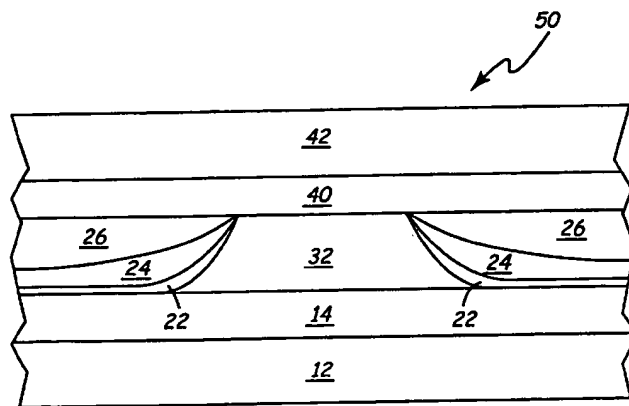


FIG. 9 shows a cross-sectional, air bearing surface (ABS) view of a finished MR reader (50). (See page 8, lines 10-11). The finished MR reader (50) includes bottom shield (12), bottom half-gap (14), permanent magnet (PM) seed layer (22), PM (24), contacts (26), MR sensor (32), top half-gap (40), and top shield (42).



Independent claim 1 is directed toward a method of forming a MR reader (50) with

planar top shield topography and low parasitic resistance. A method embodying claim 1 is illustrated in FIGS. 6-9. (See page 7, lines 8-9). The method includes first defining a stripe height back edge (30) of a MR sensor (32) of the MR reader (50). (See page 7, lines 10-14). Subsequently, as shown in FIG. 7, a reader width (18) of the MR sensor (32) is defined. (See page 7, lines 21-22). This is shown in FIGS. 7 and 8.

### Grounds of Rejection to be Reviewed on Appeal

Claims 1-8 stand rejected over the prior art. Claims 1-4 stand rejected as being anticipated by Lin under 35 U.S.C. § 102 (e). Claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin in view of Hiner. Claims 6-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin in view of Gill.

### Argument

#### I. The Lin Patent Does Not Anticipate the Claimed Invention.

Independent claim 1 stands rejected as being anticipated by Lin, U.S. Patent No. 6,262,869 under 35 U.S.C. § 102 (e). Claim 1 is directed toward a method for forming a MR reader by **defining a stripe height back edge of a MR sensor** of the MR reader, and **subsequently defining a reader width of the MR sensor**. Lin fails to teach or suggest this method. Rather, Lin directly teaches away from the claimed invention. Lin teaches a method of forming a spin valve sensor that includes **first defining a track width** of the spin valve sensor (see FIGS. 19H-I and Col. 12, lines 37-44), **and subsequently defining a stripe height**. (Col. 12, lines 55-60). As the present application states, this was the conventional method of forming a MR reader. (See page 2, lines 24-26).

The Examiner suggested that FIG. 19G of Lin teaches the step of defining a stripe height back edge of a MR sensor prior to defining the reader width. See December 30, 2004 Office Action, page 4, paragraph 8 (“...defining a stripe height back edge (back edge of the top surface of 312 in FIG. 19G)...”). This argument, however, ignores the direct teaching of Lin. Lin teaches that the spin valve sensor’s stripe height back edge is defined **after** the track width is defined, by patterning and ion milling. (See Col. 12, lines 55-60). FIGS. 19A-19L of Lin teach a method of forming a spin valve sensor, which includes three sets of processes. In a first set of processes, an encapsulated keeper layer is patterned. (Col. 12, lines 21-22). In a second set of

processes, a sensor track width is patterned. (Col. 12, lines 52-54). During this second set of processes, spin valve sensor layers (310, 304, 302, 306, 308, and 312) are deposited and a photoresist (360) is formed on the spin valve sensor layers. (Col. 12, lines 37-41). The spin valve sensor layers (310, 304, 302, 306, 308, and 312) are then ion milled to form first and second side edges (344 and 346) of a spin valve sensor. (Col. 12, lines 41-44). After various hard bias, lead, and oxide layers are deposited, the second set of processes is complete, and the sensor track width is defined. (Col. 12, lines 52-54).

It is **after** the second set of processes is complete that “a third set of processes for patterning a sensor stripe height . . . continues.” (Col. 12, lines 55-57). Lin even refers to the process of defining stripe height as the final step in forming the spin valve sensor. (Col. 12, lines 57-60). Specifically, Lin states that, “after ion milling . . . to define the sensor stripe height and bilayer photoresist removal . . . the spin valve sensor 300 has been completed, as shown in FIGS. 19M and 19N.” Lin cannot anticipate the invention of independent claim 1 because it teaches away from defining a stripe height back edge of a MR sensor prior to the defining a reader width of the MR sensor.

FIG. 19G also fails to teach the step of defining a stripe height back edge of a MR sensor prior to defining the reader width because FIG. 19G merely shows the end of a wafer and not a stripe height back edge of a sensor. FIGS. 19A-19L of Lin show various steps in the construction of a spin valve sensor occurring over an entire wafer where rows and columns of magnetic head assemblies are being constructed. (Col. 11, lines 60-66). In FIG. 19G spin valve sensor layers (310, 304, 302, 306, 308 and 312) are sputter-deposited over the entire wafer. (Col. 12, lines 23-25). Thus, the end of the top surface of 312 in FIG. 19G relied upon by the Examiner as the “stripe height back edge of a MR sensor” is merely the end of the wafer upon which the spin valve sensor is being formed. As such, this surface of the wafer does not define a stripe height back edge of a MR sensor, but is only the end of the wafer.

Even if, for the sake of argument, FIG. 19G shows a single MR sensor, it does not change the fact that the Examiner is relying upon an end of the top surface (312) of the MR sensor as the stripe height back edge. The stripe height back edge is not defined until later, after the reader width has been defined. (See Lin, col. 12, lines 23-60).

Because none of the prior art of record teaches or suggests the claimed invention, independent claim 1 is allowable. Claims 2-4 depend from claim 1 and are allowable therewith. The rejection of claims 1-4 under 35 U.S.C. § 102(e) over Lin should accordingly be reversed.

Claims 2-8 and 21-32 each depend from claim 1 and are allowable therewith, regardless of the outcome of the pending Petition Requirement for Restriction. Therefore, Applicant requests that claims 21-32 be entered and allowed upon the reversal of the rejection of claim 1, because claim 1 links claims 2-5 and 21-32.

Assuming the Petition From Restriction for Requirement is granted, independent claim 9 is also allowable over Lin for the reasons stated above. Claims 10-17 depend from independent claim 9 and are allowable therewith.

## **II. Combining the Lin and Hiner References Does Not Teach or Suggest All the Claim Limitations.**

Claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin in view of Hiner. Applicant respectfully request this rejection be reversed because combining the Lin and Hiner references does not teach or suggest all the claim limitations of claim 1, from which claim 5 depends.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). See MPEP § 2143.

The Examiner cited Hiner as suggesting "that lapping the ABS provides a smooth surface during operation of the magnetoresistive head." (December 30, 2004 Office Action, paragraph 12). Applicant does not concede the accuracy of this suggestion, however, because Hiner fails to overcome the deficiency in Lin as an anticipatory reference. Claim 5 is patentable over the cited combination of references. Accordingly, Applicant respectfully requests reconsideration and reversal of this rejection.

**III. Combining the Lin and Gill References Does Not Teach or Suggest All the Claim Limitations.**


Claims 6-8 were rejected as being unpatentable under 35 U.S.C. § 103(a) over Lin in view of Gill. Applicant respectfully requests that this rejection be reversed because combining the Lin and Gill references does not teach or suggest all the claim limitations of claim 1, from which claims 6-8 depend.

The Examiner cited Gill as showing "that it is known to form a gap layer 53 by depositing and form a top shield layer 55 by depositing, all of which is an alternative means to pattern the gap and shield layers." (citations omitted). (December 30, 2004 Office Action, paragraph 13). Applicant does not concede the accuracy of the Examiner's use of Gill as a reference, however, because Gill fails to overcome the deficiency in Lin as an anticipatory reference. Claims 6-8 are patentable over the cited combination of references. Accordingly, Applicant respectfully requests reconsideration and reversal of this rejection.

**IV. Conclusion.**

In view of the above comments, it is respectfully requested that the rejection of claims 1-8 be reversed.

Respectfully submitted,  
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Appendix A

CLAIMS ON APPEAL (1-8)

1. (Original) A method of forming a magnetoresistive reader with planar top shield topography and low parasitic resistance, the method comprising:

defining a stripe height back edge of a magnetoresistive sensor of the magnetoresistive reader; and

subsequently defining a reader width of the magnetoresistive sensor.

2. (Previously presented) The method of claim 1 wherein defining the stripe height back edge of the magnetoresistive sensor comprises:

depositing a plurality of magnetoresistive sensor layers;

selectively patterning a first photoresist layer on the magnetoresistive sensor layers, the first photoresist layer leaving exposed a first region of the magnetoresistive sensor layers; and

removing the exposed first region of the magnetoresistive sensor layers.

3. (Previously Presented) The method of claim 2 wherein defining the reader width of the magnetoresistive sensor comprises:

selectively patterning a second photoresist layer on the magnetoresistive sensor layers, the second photoresist layer leaving exposed a second region of the magnetoresistive sensor layers; and

removing the exposed second region of the magnetoresistive sensor layers.

4. (Original) The method of claim 3 and further comprising:

defining a stripe height front edge of the magnetoresistive sensor layers.

5. (Previously presented) The method of claim 4 wherein defining the stripe height front edge of the magnetoresistive sensor comprises:

lapping an air bearing surface of the magnetoresistive sensor layers.

6. (Original) The method of claim 1 and further comprising:

depositing current contacts adjacent opposite edges of the magnetoresistive sensor;  
depositing a gap layer on the current contacts and the magnetoresistive sensor; and  
depositing a top shield on the gap layer.

7. (Original) The method of claim 6 wherein a top surface of the current contacts is substantially level with a top surface of the magnetoresistive sensor layers.

8. (Original) The method of claim 6 wherein the top shield is substantially planar.

9. (Withdrawn) A method of forming a magnetoresistive reader with planar shield topography and low parasitic resistance, the method comprising:

depositing a stack of magnetoresistive sensor layers;  
selectively patterning a first photoresist layer on the stack of magnetoresistive sensor layers, the first photoresist layer serving to define a stripe height back edge of the magnetoresistive sensor by leaving exposed a first region of the stack of magnetoresistive sensor layers;  
removing the exposed first region of the stack of magnetoresistive sensor layers;  
removing the first photoresist layer;  
selectively patterning a second photoresist layer on the stack of magnetoresistive sensor layers, the second photoresist layer serving to define a reader width of the magnetoresistive sensor by leaving exposed a second region of the stack of magnetoresistive sensor layers;  
removing the exposed second region of the stack of magnetoresistive sensor layers;  
depositing current contacts such that the current contacts are in electrical contact with opposite edges of the stack of magnetoresistive sensor layers;  
removing the second photoresist layer; and  
lapping an air bearing surface of the magnetoresistive sensor to define a stripe height

front edge of the magnetoresistive sensor.

10. (Withdrawn) The method of claim 9 and further comprising:  
backfilling an insulating material into the removed first region prior to the removal of the first photoresist layer.
11. (Withdrawn) The method of claim 10 wherein the insulating material is  $\text{Al}_2\text{O}_3$ .
12. (Withdrawn) The method of claim 10 wherein the insulating material is deposited to a thickness similar to a thickness of the stack of magnetoresistive sensor layers, such that the insulating layer survives the step of removing the exposed second region.
13. (Withdrawn) The method of claim 9 wherein a top surface of the current contacts is substantially level with a top surface of the stack of magnetoresistive sensor layers.
14. (Withdrawn) The method of claim 9 and further comprising:  
depositing a top gap layer on the current contacts and on the stack of magnetoresistive sensor layers; and  
depositing a top shield layer on the top gap layer.
15. (Withdrawn) The method of claim 14 wherein the top shield layer is substantially planar.
16. (Withdrawn) The method of claim 9 wherein a pedestal, a permanent magnet seed, and a permanent magnet are sequentially deposited beneath the current contacts and adjacent to the stack of magnetoresistive sensor layers.
17. (Withdrawn) The method of claim 9 wherein a bottom shield layer and a bottom gap layer are sequentially deposited prior to the deposit of the stack of magnetoresistive sensor layers.

18. (Withdrawn) The method of claim 17 wherein the bottom shield layer and the bottom gap layer remain when exposed first region of the stack of magnetoresistive sensor layers is removed.

19. (Withdrawn) A magnetoresistive reader comprising:

a sensor;

current contacts having a top surface that is substantially level with a top surface of the sensor, and having a parasitic resistance that is independent of a stripe height of the sensor; and

a substantially planar top shield.

20. (Withdrawn) The magnetoresistive reader of claim 19 wherein the sensor has a thickness of about 400 angstroms.

21. (Withdrawn) The method of claim 1 wherein defining the stripe height back edge of the magnetoresistive sensor of the magnetoresistive reader comprises:

depositing a stack of magnetoresistive sensor layers;

selectively patterning a first photoresist layer on the stack of magnetoresistive sensor layers, the first photoresist layer serving to define a stripe height back edge of the magnetoresistive sensor by leaving exposed a first region of the stack of magnetoresistive sensor layers;

removing the exposed first region of the stack of magnetoresistive sensor layers; and

removing the first photoresist layer.

22. (Withdrawn) The method of claim 21 wherein defining a reader width of the magnetoresistive sensor comprises:

selectively patterning a second photoresist layer on the stack of magnetoresistive sensor layers, the second photoresist layer serving to define a reader width of the magnetoresistive sensor by leaving exposed a second region of the stack of magnetoresistive sensor layers; and

removing the exposed second region of the stack of magnetoresistive sensor layers.

23. (Withdrawn) The method of claim 22 and further comprising:

depositing current contacts such that the current contacts are in electrical contact with

opposite edges of the stack of magnetoresistive sensor layers;

removing the second photoresist layer; and

lapping an air bearing surface of the magnetoresistive sensor to define a stripe height front edge of the magnetoresistive sensor.

24. (Withdrawn) The method of claim 23 and further comprising:

backfilling an insulating material into the removed first region prior to the removal of the first photoresist layer.

25. (Withdrawn) The method of claim 24 wherein the insulating material is  $\text{Al}_2\text{O}_3$ .

26. (Withdrawn) The method of claim 24 wherein the insulating material is deposited to a thickness similar to a thickness of the stack of magnetoresistive sensor layers, such that the insulating layer survives the step of removing the exposed second region.

27. (Withdrawn) The method of claim 23 wherein a top surface of the current contacts is substantially level with a top surface of the stack of magnetoresistive sensor layers.

28. (Withdrawn) The method of claim 23 and further comprising:

depositing a top gap layer on the current contacts and on the stack of magnetoresistive sensor layers; and

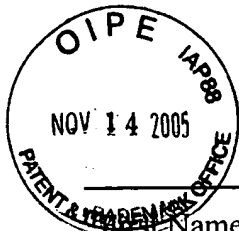
depositing a top shield layer on the top gap layer.

29. (Withdrawn) The method of claim 28 wherein the top shield layer is substantially planar.

30. (Withdrawn) The method of claim 23 wherein a pedestal, a permanent magnet seed, and a permanent magnet are sequentially deposited beneath the current contacts and adjacent to the stack of magnetoresistive sensor layers.

31. (Withdrawn) The method of claim 23 wherein a bottom shield layer and a bottom gap layer are sequentially deposited prior to the deposit of the stack of magnetoresistive sensor layers.

32. (Withdrawn) The method of claim 31 wherein the bottom shield layer and the bottom gap layer remain when exposed first region of the stack of magnetoresistive sensor layers is removed.



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named

Inventor : Dimitar V. Dimitrov

Appln. No. : 10/050,236

Filed : January 15, 2002

Title : METHOD FOR FORMING A MR READER  
WITH REDUCED SHIELD TOPOGRAPHY  
AND LOW PARASITIC RESISTANCE

Docket No. : I69.12-0526

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Tugbang, Anthony D.

**EXPRESS MAIL COVER SHEET**

Mail Stop Appeal Brief-Patents  
Commissioner For Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**SENT VIA EXPRESS MAIL**

Express Mail No.: EV 655617876 US

The following papers are being transmitted via **EXPRESS MAIL** to the U.S. Patent and Trademark Office on the date shown below:

1. Brief for Appellant with Appendix A;
2. Check in the amount of \$500.00;
3. Fee Transmittal Sheet (in duplicate); and
4. Return Receipt Postcard.

Respectfully submitted,

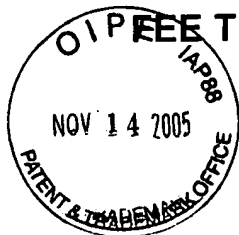
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Date: 11/14/05

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## OIP FEE TRANSMITTAL

Total Amount of Payment **\$500.00**

## Complete if Known

Application No.	10/050,236
Filing Date	January 15, 2002
First Named Inventor	Dimitar V. Dimitrov
Group Art Unit	3729
Examiner Name	Tugbang, Anthony D.
Atty. Docket Number	169.12-0526

## METHOD OF PAYMENT (Check One)

1. ☒ The Commissioner is hereby authorized to charge any additional fee required under 37 C.F.R. 1.16 and 1.17 and credit any over payments to Deposit Account No. 11-0982. Deposit Account Name: Kinney & Lange, P.A. A duplicate copy of this communication is enclosed.

2. ☒ Check Enclosed

## FEE CALCULATION

## 1. BASIC FILING FEE

Appn. Type	FILING FEE FEE/SMALL	SEARCH FEES FEE/SMALL	EXAM FEES FEE/SMALL	FEES PD.
Utility	300 / 150	500 / 250	200 / 100	—
Design	200 / 100	100 / 50	130 / 65	—
Reissue	300 / 150	500 / 250	600 / 300	—
Provisional	200 / 100	-0 / -0-	-0 / -0-	—

Subtotal (1) \$0.00

## 2. EXTRA CLAIM FEES

	Number Claims	Prior**	Extra	Fee from Fee Paid Below	
Total	*	=	* X	*	*
Indep.	*	=	* X	*	*
Multiple Dependent Claims				*	*

\*\*Insert 3 and 20, or number previously paid if greater; Reissue see below

Large Entity Fee Code	Fee (\$)	Small Entity Fee Code	Fee (\$)	Description
1202	50	2202	25	Claims in excess of 20
1201	200	2201	100	Independent claims in excess of 3
1203	360	2203	180	Multiple Dependent Claim
1204	200	2204	100	Reissue Independent Claims Over Original Patent
1205	50	2205	25	Reissue claims in excess of 20 and over original patent

## 3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 small) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 C.F.R. 1.16(s).

Subtotal (2) \$0.00

## FEE CALCULATION (Continued)

## 3. ADDITIONAL FEES

Large Entity Fee Code	Fee (\$)	Small Entity Fee Code	Fee (\$)	Fee Description	Fee paid
1051	130	2051	65	Surcharge - Late filing fee or oath	*
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	*
1053	130	1053	130	Non-English specification	*
1812	2,520	1812	2,520	For Filing a Request for Reexamination	*
1251	120	2251	60	Extension for reply within first month	*
1252	450	2252	225	Extension for reply within second month	*
1253	1,020	2253	510	Extension for reply within third month	*
1254	1,590	2254	795	Extension for reply within fourth month	*
1255	2,160	2255	1,080	Extension for reply within fifth month	*
1402	500	2402	250	Filing a brief in support of an appeal	X
1403	1,000	2403	500	Request for oral hearing	*
1814	130	2814	65	Terminal Disclaimer Fee	*
1452	500	2452	250	Petition to revive - unavoidable	*
1453	1,500	2453	750	Petition to revive - unintentional	*
1501	1,400	2501	700	Utility/Reissue issue fee	*
1502	800	2502	400	Design issue fee	*
1460	130	1460	130	Petitions to the Commissioner	*
1807	50	1807	50	Petitions related to provisional applications	*
1806	180	1806	180	Submission of Information Disclosure Statement	*
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	*
1801	790	2801	395	Request for Continued Examination (RCE)	*

Other fee (specify) \_\_\_\_\_

Subtotal (3) \$500.00

Signature Dina M. Khaled  
Date 11/14/05

Reg. No. 52,761  
Deposit Account No. 11-0982